

Technology Partnering with General Motors

Oak Ridge National Laboratory

Tennessee Transportation Manufacturer' Showcase

~~September 18-19, 2001~~ May 6-7, 2002, Oak Ridge, Tennessee

Nuno Vaz, GM R&D

GM Vision

Be the world leader in transportation products and related services. We will earn our customers' enthusiasm through continuous improvement driven by the integrity, teamwork, and **innovation** of GM people.

GM Core Values

Innovation

We will challenge conventional thinking, explore new technology and implement new ideas, regardless of their source, faster than the competition.

Auto Show Concepts



New Technology and Innovations: GM R&D Center Contact



General Motors

Nuno A. Vaz, Ph. D.

Manager

Government & Academic
Partnerships

***GM R&D and Planning
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New Technology and Innovations: GM Purchasing Contact



General Motors

Lydia Sobo

Supervisor

Worldwide Purchasing

New Technology

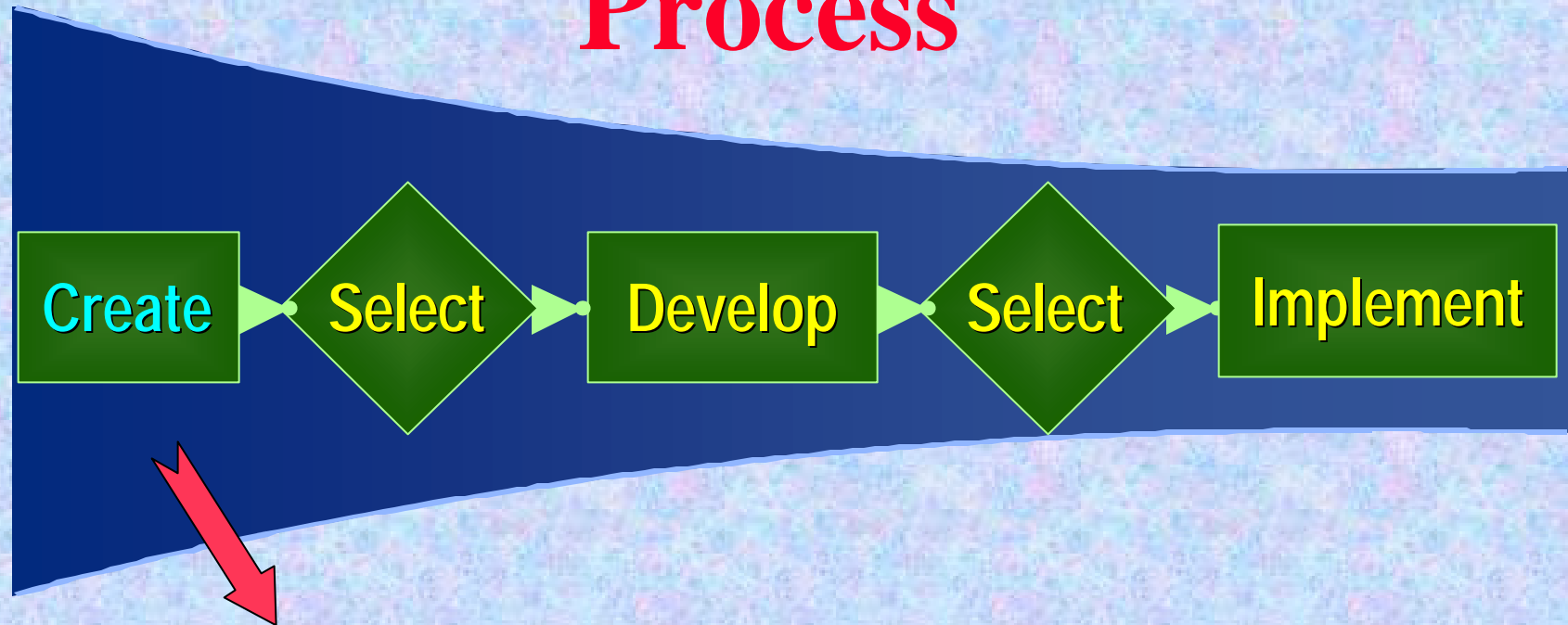
*Advance Purchasing
Mail Code 480-205-201
30007 Van Dyke Avenue
Warren, MI 48090-9065*

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lydia.sobo@gm.com

Technology Management Process



Create Ideas

Create

Create Ideas

Employees

Suppliers

Customers
& Dealers

Laboratories
& Universities

Ideas
Submitted

Select

Interfaces

- 1 Idea Submittal Forms (ISFs)
 - 2 TechWorlds (TWs)
 - 3 Discovery Days (DDs)
 - 4 Creativity Teams (CTs)
 - 5 Millenium Room Displays (MRDs)
 - 6 Single Mission Challenges (SMCs)
- Peer Reviews

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Idea Submittal Forms (ISF)

New Technology and Innovation Submittal Form

- Explain why idea is new and unique, and how both GM and our customers would benefit from adopting this technology
- Explain why idea is new and unique, and how both GM and our customers would benefit from adopting this technology
- Do not include any confidential or proprietary information
- Give enough data to weigh the merit of your submission (just estimates - not quotes or bids)
- Graphics, test results, patent information, brochures, etc., may be attached
- Engineering and Marketing people evaluate each submission
- Forms must be complete and submitted electronically
- Initial response to your submittal within two weeks

NEW TECHNOLOGY AND INNOVATIONS SUBMITTAL FORM

Technology _____
Supplier _____
Address _____

Contact _____
Phone _____
Fax _____
E-Mail _____

Return to: GM Advance Purchasing
MC 480-205-201
Warren, MI 48090-9025
ATTN: (Buyer name)

Item # _____

Simple Illustration and/or Drawing

Mass est. (kg): _____

Cost est. (US\$): _____

Investment est. \$): _____

Testing (Yr): _____

Validation (Yr): _____

MY Avail. (Ltd. Prod.) _____

MY Avail. (Full Prod.): _____

In what stage of development is Technology?

If concept stage, what is confidence level (%) of
feasibility & actual development of Technology?
_____ %

Risk Rating: (Low to High) _____

Describe Technology & Function/Features (non-confidential description):

Explanation of Mass Estimate (if necessary):

Explanation of Cost Estimate (if necessary):

Key Customer Selling Points (safety, comfort, environmental, etc.):

Benefits of Technology:

Impact of Technology at Veh Architecture Level (Performance & Packaging):

Competitive Advantage of Technology:

List any Disadvantages of this Technology:

Is Technology Patented _____ Patent Pending _____ No Patent _____ Patent Number _____

Roadblocks to Overcome to Introduce New Technology:

GM Purch. Contact _____

Phone No. _____

Date Received _____

NEW TECHNOLOGY AND INNOVATIONS SUBMITTAL FORM

Return to: GM Advance Purchasing
MC 480-205-201
Warren, MI 48090-9025
ATTN: (Buyer name)

Technology What do you call your idea?

Contact Your Name

Supplier Supplier Name

Phone/Fax Your Phone/Fax #'s

Address Street Address

E-Mail Your E-Mail address

Item Number Leave Blank

City, State and Zip

Simple Illustration and/or Drawing

Include illustration here or in an attachment.

A picture is worth a thousand words!

SAMPLE

Mass est. (kg): Estimated weight of your product

Cost est. (US\$): Estimated cost of your product

Investment est. \$): Estimated tooling costs

Testing (Yr): When will product testing take place?

Validation (Yr): When will validation take place?

MY Avail. (Ltd. Prod.): Model Yr ltd prod will be avail.

MY Avail. (Full Prod.): Model Yr full prod will be avail.

In what stage of development is Technology?

Concept stage

If concept stage, what is confidence level (%) of feasibility & actual development of Technology?
60%

Risk Rating: (Low to High) Your risk evaluation

Describe Technology & Function/Features (non-confidential description):

Describe your idea as completely as possible without including confidential information. Any material that says "Confidential" will not be accepted. Additional information may be attached to this form.

Explanation of Mass Estimate (if necessary): If your answer to a mass estimate is "it depends", this is the place to explain.

Explanation of Cost Estimate (if necessary): If your answer to a cost estimate is "it depends", this is the place to explain.

Key Customer Selling Points (safety, comfort, environmental, etc.): How will this technology make customers want to buy our vehicles?

Benefits of Technology: How will this improve GM vehicles?

Impact of Technology at Veh Architecture Level (Performance & Packaging): Will the structure of the vehicle have to change to accommodate this technology? Will it need extra room under the hood? Does it weigh more than current technology? Does it increase/decrease interior space?, etc.

Competitive Advantage of Technology: How is your technology better than other competitors?

List any Disadvantages of this Technology: Are there any negatives that we should be aware of?

Is Technology Patented _____ **Patent Pending** ___X___ **No Patent** _____ **Patent Number** _____

Roadblocks to Overcome to Introduce New Technology: What may stand in the way of implementing this technology?

GM Purch. Contact Leave blank

Phone No. Leave blank

Date Received Leave blank

¹ Technology Levels & Risk Ratings Chart

Level	Usage	Work Required	Risk
1 Production	In GM production	Application specific	Low
2 Verification	In competition vehicle production of GM development	Validation of technology to GM requirements	Low
3 Development	In competition production, but needs modification to meet GM requirements or in GM mule vehicles	Analysis, design and build of technology demonstration	Med.
4 Feasibility	No production applications	Proof of concept using analysis and/or hardware	High
5 Idea	No production applications	Selection of technology concept	High

New Technology and Innovation Review

- Create Communication between GM and supplier technology stakeholders
- Share GM Technology Management Process with global technology leaders
- Review features, processes, technologies, industry trends, and concepts in development 7 -15 years in the future
- Sponsored by Engineering, R&D, Planning, Worldwide Purchasing and Technology Work Group

New Technology and Innovation Exploration

- **Create Communication** between GM and supplier technology stakeholders
- **Review potential features**, processes, technologies, industry trends, and concepts

New Technology and Innovation Generation

- **Create Communication** between GM and supplier technology stakeholders
- **Discuss and develop** new features, processes, technologies, industry trends, and concepts

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Millenium Room Displays (MRDs)

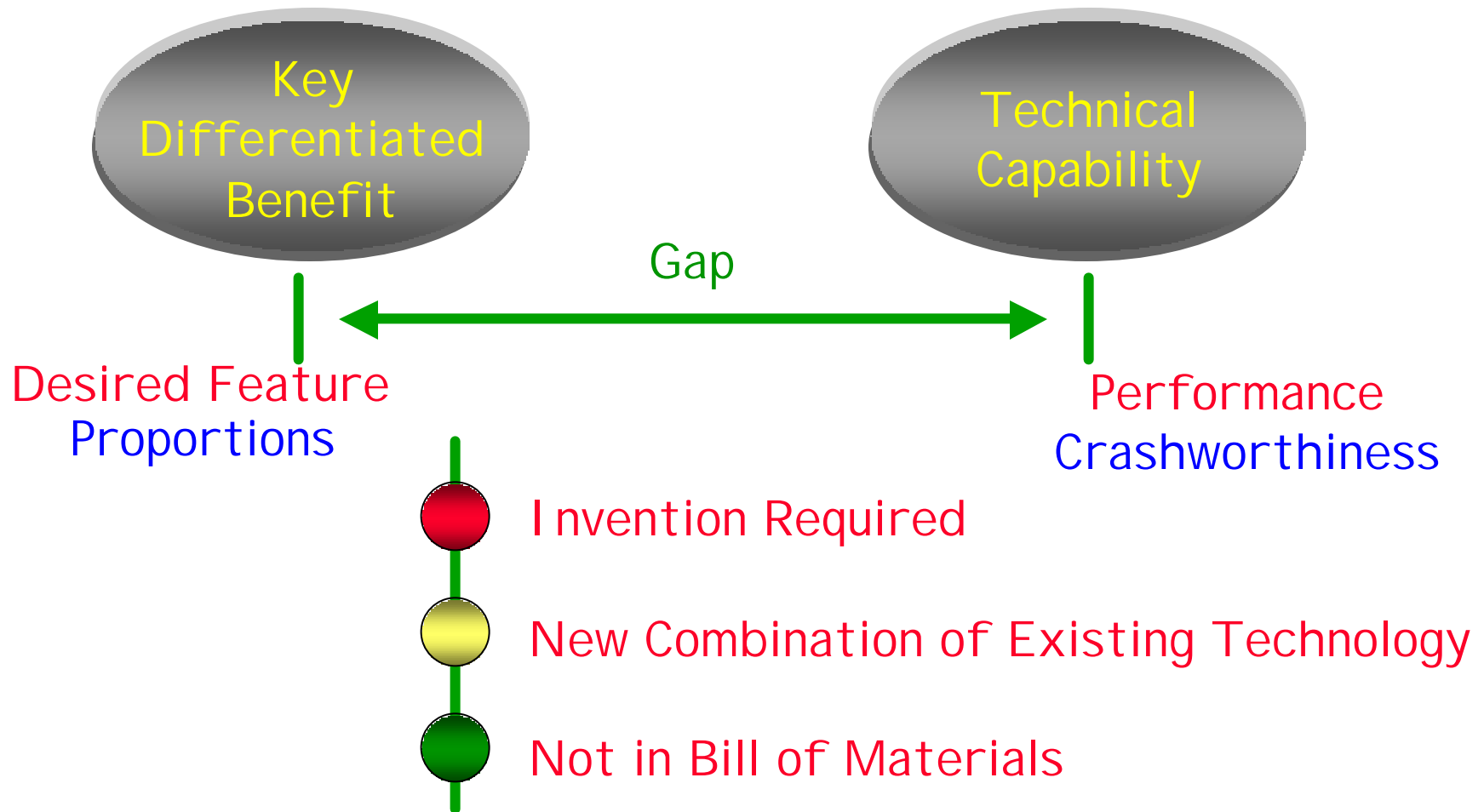
Technology Display

- Integrated with needs and ideas
- Right people at the right time
- GM Secret - no suppliers, limited GM access
- Contact Advanced Purchasing Representative for more information

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Single Mission Challenges (SMCs)

Technology Gap Definition





New Technology Search - AREAS OF INTEREST

DRIVER WORKLOAD

- Driver Workload monitoring
- Strategies to manage driver work load
- New consumer electronics that might be used in vehicle

VEHICLE ELECTRICAL ARCHITECTURE

- Wireless technologies
- Communication standards
- Fiber optics
- Bluetooth® Applications & uses
- MOST® optical bus
- IEEE 1394 onboard vehicles
- On Vehicle Vs. Server based services
- “X” by Wire Systems – Chassis – brakes, steering handling

TELEMATICS

- Next generation Navigation Systems
- Monitoring Traffic Flow and Real time route guidance
- Integration of Portable Devices in Vehicle
- Handheld units that “do everything”

ENTERTAINMENT

- CD ROM systems for MP3
- Audio DVD status
- New Consumer Electronics

SENSORS & ACTUATORS

- Smart Sensors and Actuators
- Air Bag Suppression Technologies & Development Status
- Interior compartment sensors (for detecting presence, classification etc., of passengers)
- Night Vision Systems
- Vision (Camera) Based Systems

DISPLAY TECHNOLOGY

- Organic Electroluminescence
- Plasma Display Panel
- Field Emission Display
- Others?

ELECTRICAL POWER & BATTERIES

- Advances in NmiH or Li Ion batteries for EV's hybrids
- High Current (190 amp) Air cooled Alternators
- 42 V Systems and Components

LIGHTING

- Advanced Forward Lighting (bending light around curves, auto dimming, unique packages.)
- LEDs (for exterior lighting, Red, Amber and White)
- Interior Lighting Technologies



New Technology Search - AREAS OF INTEREST

ACTIVE SAFETY

- Adaptive Cruise Control
- "Stop & Go" Adaptive Cruise Control
- Forward Collision Warning
- Lane Change Support
- Lane Departure Warning
- Side Object Detection
- Vehicle Stability Control
- Automation of Driving Functions
- Vision Based Systems

HVAC

- Status and Timing of Alternate Refrigerant - Cycles (CO₂)
- Status of 42V HVAC systems and components
 - Power Consumption Comparison
 - Advantages/Disadvantages over Belt Driven
- Refrigerant sealing technology
 - What is the recommended sealing technology for R134a
 - How does this compare to other sealing
- Technologies to reduce the space required for the HVAC in the interior of the vehicle

POWERTRAIN

- Sensors
- Controllers
- Software development process and tools
- Algorithm development
- Camless engines
- Integrated Starter Generator - "mild hybrid"
- Plasma after-treatment systems

FUEL CELL TECHNOLOGIES

BODY

- Use of Body Aluminum/Light Weight Materials

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SATURN VUE



General Motors